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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/597,062	07/10/2006	Michael R. Thompson	PHUS040037US2	6959

38107 7590 02/07/2008

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
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CLEVELAND, OH 44143

EXAMINER	
VAUGHN, MEGANN E	
ART UNIT	PAPER NUMBER
2859	

MAIL DATE	DELIVERY MODE
02/07/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/597,062	THOMPSON ET AL.	
	Examiner	Art Unit	
	MEGANN E. VAUGHN	2859	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12,14,15 and 18-27* is/are rejected.

7)☒ Claim(s) *13,16 and 17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 July 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/10/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 6-12, and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Harvey (US 6275038).

Regarding claim 1, Harvey discloses a magnetic resonance method (Abstract) comprising: performing magnetic resonance imaging in a main magnetic field; measuring spatial data corresponding to the main magnetic field (column 2, lines 17-39); and determining at least one main magnetic field nonuniformity parameter from the spatial data corresponding to the main magnetic field (column 2, lines 40-51); wherein: the measuring and determining are performed concurrently with the performing of magnetic resonance imaging (column 2, lines 40-51).

Regarding claim 2, Harvey discloses that the performing of magnetic resonance imaging comprises: acquiring a magnetic resonance imaging repetition, frame or dynamic, the acquiring including acquiring volumetric magnetic resonance imaging data; repeating the acquiring; and interspersing the measuring between or concurrently with repetitions of the acquiring (column 3, lines 16-30).

Regarding claim 6, Harvey discloses that the measuring and determining comprise: reading at least two gradient echoes using magnetic field gradients imposed along a selected direction (column 3, lines 30-34); and computing a nonuniformity of the main magnetic field along the selected direction from the at least two gradient echoes (column 3, lines 16-30).

Regarding claim 7, Harvey discloses repeating the reading and computing for a plurality of selected directions (column 3, lines 30-42); and mapping the main magnetic field based on the computed nonuniformities along the selected direction (column 3, lines 16-30).

Regarding claim 8, Harvey discloses that the reading of at least two gradient echoes comprises: applying a balanced magnetic field gradient along the selected direction, the balanced magnetic field gradient having at least two lobes of same polarity separated by a lobe of opposite polarity (column 3, lines 30-35); and reading the at least two gradient echoes during the two lobes of same polarity (see figure 1).

Regarding claim 9, Harvey discloses in figure 1 that the reading of at least two gradient echoes comprises: prior to the reading of the at least two gradient echoes (36), applying a radio frequency excitation (22).

Regarding claim 10, Harvey discloses applying of a radio frequency excitation comprises: applying a radio frequency excitation having a low flip angle (see figure 1; column 4, lines 62-63).

Regarding claim 11, Harvey discloses reading at least two other gradient echoes using magnetic field gradients imposed along a different direction (column 3, lines 30-

41); and wherein the readings along the selected direction and along the different direction detect magnetic resonance excited by the same said applied radio frequency excitation (column 3, lines 41-47).

Regarding claim 12, Harvey discloses that the computing comprises: Fourier transforming each gradient echo to reconstruct a projection along the selected direction; and computing a complex phase difference between the projections reconstructed from the at least two gradient echoes, the nonuniformity of the main magnetic field along the selected direction corresponding to the complex phase difference (column 3, lines 55-67).

Regarding claim 18, Harvey discloses that the measuring of spatial data corresponding to a main magnetic field comprises: exciting and sampling magnetic resonance in an imaging subject of the magnetic resonance imaging; and deriving spatial data corresponding to the main magnetic field from the sampled magnetic resonance (column 12, lines 59-63).

3. Claims 1, 3-5, 14, 15, 19, 26, and 27 are rejected under 35 U.S.C. 102(a) as being anticipated by Roopchansingh et al (US 2004/0254449).

Regarding claims 1, 14, 15, and 19, Roopchansingh et al discloses a magnetic resonance method and apparatus comprising: performing magnetic resonance imaging in a main magnetic field; measuring spatial data corresponding to the main magnetic field (page 1, [0011]-[0012]); and determining at least one main magnetic field nonuniformity parameter from the spatial data corresponding to the main magnetic field

(page 1, [0011]-[0012]); wherein: the measuring and determining are performed concurrently with the performing of magnetic resonance imaging (page 1, [0011]-[0012]).

Regarding claim 26, Roopchansingh et al discloses in figure 1 a magnetic resonance imaging apparatus comprising: a magnetic resonance imaging scanner performing magnetic resonance imaging (10), the scanner including: a main magnet (12) generating a main magnetic field, magnetic field gradient coils (20), and at least one radio frequency antenna (18); at least one magnetic field sensor (24) measuring spatial data corresponding to the main magnetic field; and a processor (26) programmed to perform the method of claim 1 to determine the nonuniformity parameter.

Regarding claim 3, Roopchansingh et al discloses acquiring a magnetic resonance imaging repetition, frame or dynamic, the acquiring including acquiring volumetric magnetic resonance imaging data; repeating the acquiring; computing a main magnetic field shim current based on the determined at least one main magnetic field nonuniformity parameter; and applying the computed main magnetic field shim current during the acquiring of a subsequent magnetic resonance imaging repetition, frame or dynamic (page 2, [0022]-[0023]).

Regarding claim 4, Roopchansingh et al discloses compensating for a change in the main magnetic field by adjusting the main magnetic field based on the at least one main magnetic field nonuniformity parameter (page 1, [0011]; page 2, [0022]-[0023]).

Regarding claim 5, Roopchansingh et al discloses compensating for a change in the main magnetic field by adjusting an image reconstruction of imaging data collected by the performing of magnetic resonance imaging based on the at least one main magnetic field nonuniformity parameter (page 1, [0011]).

Regarding claim 27, Roopchansingh et al discloses in figure 1, shim coils (22) for shimming the main magnetic field; and a reconstruction processor; the processor being operatively connected with at least one of the shim coils and the reconstruction processor to adjust at least one of shim coil currents and resonance data reconstruction in accordance with the nonuniformity parameter (page 2, [0035]).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 20-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roopchansingh et al (US 2004/0254449) in view of Ehnholm et al (US 5882304).

Regarding claims 20 and 21, Roopchansingh et al discloses the magnetic resonance imaging apparatus as set forth in claim 19 as stated above in paragraph 3. Roopchansingh et al does not disclose a plurality of magnetic field sensors, Hall effect magnetic field sensors, disposed in the main magnetic field, the plurality of magnetic field sensors operating independently from the imaging means.

Ehnholm et al discloses an MRI apparatus with additional Hall effect sensors (column 7, lines 25-27). Therefore it would have been obvious to a person having ordinary skill in the art at the time that the invention was made for Roopchansingh et al to add Hall effect sensors, as taught by Ehnholm, to the disclosed MRI apparatus since Hall effect sensors are common magnetic field sensors in the art to measure that actual magnetic field.

Regarding claim 22, Roopchansingh et al discloses in figure 1 one or more radio frequency receive coils (18) of the imaging means.

Regarding claim 23, Roopchansingh et al discloses in figure 1 a ferromagnetic structure (shimming coils; 22) disposed in the main magnetic field, the ferromagnetic structure inducing changes in the main magnetic field over time responsive to the magnetic resonance imaging (page 2, [0035]).

Regarding 24, Roopchansingh et al discloses means for adjusting the main magnetic field during the magnetic resonance imaging based on the at least one main magnetic field nonuniformity parameter (page 2, [0022]-[0023]; [0035]).

Regarding claim 25, Roopchansingh et al discloses a means for reconstructing imaging data acquired by the means for performing magnetic resonance imaging, the reconstructing means adjusting the reconstructing based on the at least one main magnetic field nonuniformity parameter (page 2, [0023]).

Allowable Subject Matter

6. Claims 13, 16, and 17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance:

Claim 13 is allowable over the prior art of record because the prior art of record does not teach or disclose the magnetic resonance method wherein the reading of at least two gradient echoes using magnetic field gradients imposed along a selected direction comprises: imposing the multi-lobe magnetic field gradient includes at least five lobes along the selected direction, the multi-lobe magnetic field gradient including a -a:+b:-b:+b:-a lobe area ratio where a and b represent gradient lobe areas and the positive and negative signs represent gradient lobe polarities, in combination with the remaining limitations of the claims

Claims 16-17 are allowable over the prior art of record because the prior art of record does not teach or disclose the magnetic resonance method wherein the measuring of spatial data corresponding to a main magnetic field comprises exciting a sampling magnetic resonance at a resonance frequency different from the resonance frequency used in performing the magnetic resonance imaging, in combination with the remaining limitations of the claims.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Axel (US 2005/0248348).

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MEGANN E. VAUGHN whose telephone number is (571)272-8927. The examiner can normally be reached on 8 am- 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dean Reichard can be reached on 571-272-1984. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MEV
Patent Examiner Art Unit 2859
2/4/2008

2.4.08
BRIJ SHRIVASTAV
PRIMARY EXAMINER